

WHAT IS CLAIMED IS:

1 1. A method of installing a cable in an inner
2 pathway comprising the steps of:
3 providing a duct with a collapsible wall to form
4 said inner pathway, said collapsible wall being movable
5 between an extended condition to provide the duct with a
6 first cross-sectional area and a contracted condition to
7 provide said duct with a second cross-sectional area
8 smaller than said first cross-sectional area,
9 inserting said duct with said collapsible wall in
10 said contracted condition into said outer conduit,
11 moving said collapsible wall to said extended
12 condition to provide said duct with said first cross-
13 sectional area,
14 inserting said cable into said duct with said
15 collapsible wall in said extended condition, and
16 moving said collapsible wall to said contracted
17 condition with said cable extending through said duct
18 within said outer conduit.

1 2. A method as in claim 1, wherein said duct has a
2 tubular shape and a generally first oval or circular
3 cross-section when said collapsible wall is in the
4 extended condition and a flattened tubular shape and a
5 generally second oval cross-section when said collapsible
6 wall is in the contracted condition.

1 3. A method as in claim 1, wherein said duct has a
2 longitudinal axis and a closed duct wall extending about
3 said axis, and said collapsible wall forms a major
4 circumferential portion of said duct wall.

1 4. A method as in claim 3, wherein said collapsible
2 wall forms substantially all of said closed duct wall.

1 5. A method as in claim 1, including the step of
2 providing a plurality of said pathways respectively
3 formed by a plurality of said ducts.

1 6. A method as in claim 5, wherein said plurality
2 of ducts are secured together along their longitudinal
3 lengths to form a duct assembly, and said duct assembly
4 with said collapsible walls in said contracted condition
5 is inserted into an outer conduit.

1 7. The method as claimed in claim 1, including the
2 step of pressurizing said duct before said cable is
3 inserted and then depressuring said duct.

1 8. A method as in claim 2, wherein said collapsible
2 wall has a multiple layer construction including an outer
3 protective layer, an inner liner layer for engaging said
4 cable, a reinforcing layer extending between said outer
5 layer and liner layer for increasing the hoop strength of
6 said duct.

1 9. A method as in claim 8, wherein said inner liner
2 layer has a profiled surface to decrease frictional
3 resistance as said cable is inserted in said duct.

1 10. A method as in claim 9, wherein said profiled
2 surface includes one of longitudinal ribs, oscillating
3 ribs or spiral ribs.

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1 11. A method as in claim 8, wherein said outer
2 protective layer has longitudinal and circumferential
3 grooves.

1 12. A method of installing a cable in an inner
2 pathway extending within an outer conduit comprising the
3 steps of:

4 providing duct means including collapsible wall
5 means to form said inner pathway, said collapsible wall
6 means being movable between an extended condition to
7 provide said duct means with a first cross-sectional area
8 and a contracted condition to provide said duct means
9 with a second cross-sectional area smaller than said
10 first cross-sectional area,

11 inserting said duct means with said collapsible wall
12 means in said contracted condition into said outer
13 conduit,

14 moving said collapsible wall means to said extended
15 condition to provide said duct means with said first
16 cross-sectional area,

17 inserting said cable into said duct means with said
18 collapsible wall means in said extended condition, and

19 moving said collapsible wall means to said
20 contracted condition with said cable extending through
21 said duct means within said outer conduit.

1 13. A method as set forth in claim 12, wherein said
2 duct means comprise a plurality of ducts having tubular
3 shapes secured together along their longitudinal axes,
4 and said collapsible wall means includes a plurality of
5 collapsible walls, one of said collapsible walls being
6 associated with each of said ducts.

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1 14. A method as in claim 13, wherein at least one
2 of said ducts has a tubular shape and a generally oval or
3 circular cross-section when said collapsible wall is in
4 the extended condition and a flattened tubular shape and
5 a generally oval cross-section when said collapsible wall
6 is in the contracted condition.

1 15. A method as in claim 13, wherein said at least
2 one duct has a longitudinal axis and a closed duct wall
3 extending about said axis, and said collapsible wall
4 forms a major circumferential portion of said duct wall.

1 16. A method as in claim 15, wherein said
2 collapsible wall forms substantially all of said closed
3 duct wall.

1 17. A method as in claim 13, wherein said
2 collapsible wall has a multiple layer construction
3 including an outer protective layer, an inner liner
4 layer for engaging said cable, a reinforcing layer
5 extending between said outer layer and liner layer for
6 increasing the hoop strength of said duct.

1 18. A method as in claim 17, wherein said liner
2 layer has a profiled surface to decrease frictional
3 resistance as said cable is inserted in said duct.

1 19. A method as in claim 18, wherein said profiled
2 surface includes one of longitudinal ribs, oscillating
3 ribs or spiral ribs.

1 20. A method as in claim 17, wherein said outer
2 protective layer has longitudinal and circumferential
3 grooves.

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1 21. A method as in claim 13, wherein the step of
2 inserting said duct means into said outer conduit
3 includes one of pulling or pushing said ducts through
4 said outer conduit in a staggered group or in a plurality
5 of sequential groups.

1 22. A method as claim 12, wherein said outer
2 conduit is a utility service line.

1 23. A method as in claim 22, further including the
2 steps of providing an adjustable opening in said service
3 line for receiving said duct means, adjusting said
4 opening to a clearance position for receiving said duct
5 means with sufficient clearance to insert said duct means
6 into said service line and to insert said cable into said
7 duct means when the duct means is in said extended
8 condition, and, after said step of moving said
9 collapsible wall means to said contracted condition,
10 adjusting said adjustable opening to a sealing position
11 for engaging said duct means in a fluid tight seal with
12 said wall means in said contracted condition.

1 24. A method as in claim 23, further including the
2 steps of providing said first mentioned adjustable
3 opening in said service line at an entrance location for
4 said duct means, providing a second adjustable opening in
5 said service line at an exit location for said duct
6 means, said second adjustable opening also being operable
7 between clearance and sealing positions, extending said
8 duct means and cable through said service line and said
9 second adjustable opening in said clearance position, and
10 adjusting said first and second openings to said sealing
11 positions for engaging said duct means with said wall

10079295-022002

12 means in said contracted condition in fluid tight seals
13 and thereby sealing said service line.

1 25. A conduit having a longitudinally extending
2 duct means providing an inner pathway for receiving a
3 cable, said duct means including collapsible wall means
4 extending longitudinally within said conduit, said
5 collapsible wall means being movable between an extended
6 condition to provide said duct means with a first cross-
7 sectional area and a contracted condition to provide said
8 duct means with a second cross-sectional area smaller
9 than said first cross-sectional area.

1 26. A conduit as in claim 25, wherein said duct
2 means has a longitudinal axis and said collapsible wall
3 means includes a closed duct wall extending about said
4 axis, and said duct wall includes a collapsible wall
5 forming a major circumferential portion of said duct
6 wall.

1 27. A conduit as in claim 26, wherein said
2 collapsible wall forms substantially all of said closed
3 duct wall.

1 28. A conduit as in claim 25, wherein said duct
2 means includes a plurality of ducts forming a plurality
3 of said inner pathways.

1 29. A conduit as in claim 28, wherein said
2 plurality of ducts are secured together along their
3 longitudinal lengths to form a duct assembly, said duct
4 assembly extending in said conduit with said collapsible
5 walls in said contracted condition.

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1 30. A conduit as in claim 26, wherein said
2 collapsible wall has a multiple layer construction
3 including an outer protective layer, an inner liner layer
4 for engaging said cable, a reinforcing layer extending
5 between said outer layer and liner layer for increasing
6 the hoop strength of said collapsible wall.

1 31. A conduit as in claim 30, wherein said liner
2 layer has a profiled surface to decrease frictional
3 resistance as said cable is inserted in said duct means.

1 32. A conduit as in claim 31, wherein said profiled
2 surface includes longitudinal ribs, oscillating ribs or
3 spiral ribs.

1 33. A conduit as claim 25, wherein said conduit is
2 a pipeline.

1 34. A conduit as in claim 33, wherein said pipeline
2 includes a wall having an inlet opening for receiving
3 said duct means, clamp means mounted to said pipeline and
4 having an adjustable opening communicating with said
5 inlet opening for receiving and introducing said duct
6 means into said pipeline, said adjustable opening being
7 operable between a clearance position and a sealing
8 position, said adjustable opening in said clearance
9 position receiving said duct means with sufficient
10 clearance to insert said duct means into said service
11 line and to insert said cable into said duct means when
12 said wall means is in said extended condition, said
13 adjustable opening in said sealing position engaging said
14 duct means with said wall means in said contracted
15 condition in a fluid tight seal and sealing said inlet

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16 opening with said duct means and cable extending there
17 through into said pipeline.

1 35. A conduit as in claim 34, wherein said inlet
2 opening is located at an entrance location for said duct
3 means in said pipeline, said pipeline has an outlet
4 opening extending through said pipeline wall at an exit
5 location for said duct means in said pipeline, a second
6 clamp means is mounted to said pipeline at said exit
7 location with a second adjustable opening communicating
8 with said outlet opening, said second adjustable opening
9 also being operable between a clearance position and a
10 sealing position, said duct means and cable extending
11 into said pipeline through said first adjustable opening
12 at said entrance location, through said pipeline to said
13 exit location and exiting from said pipeline through said
14 second adjustable opening at said exit location, whereby
15 said adjustable openings in said sealing positions engage
16 said duct means with said wall means in said contracted
17 condition in fluid tight seals and thereby seal said
18 service line.

1 36. A conduit as claim 35, wherein said pipeline is
2 a utility service line.

1 37. A duct for providing an inner pathway for
2 receiving a cable, said duct having a longitudinal axis
3 and a closed duct wall extending about said axis, said
4 duct wall including a collapsible wall portion movable
5 between an extended condition to provide said duct with a
6 first cross-sectional area and a contracted condition to
7 provide said duct with a second cross-sectional area
8 smaller than said first cross-sectional area, said
9 collapsible wall having a multiple layer construction

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10 including an outer protective layer, an inner liner layer
11 for engaging said cable, a reinforcing layer extending
12 between said outer layer and liner layer for increasing
13 the hoop strength of said collapsible wall.

1 38. A duct as set forth in claims 37, wherein said
2 duct has a tubular shape and a generally first oval or
3 circular cross-section when said collapsible wall is in
4 the extended condition and a flattened tubular shape and
5 a generally oval cross-section when said collapsible wall
6 is in the contracted condition.

1 39. A duct as in claim 38, wherein said liner layer
2 has a profiled surface to decrease frictional resistance
3 as said cable is inserted in said duct, said profiled
4 surface including longitudinal ribs.

1 40. A duct as in claim 38, wherein said profiled
2 surface includes longitudinal ribs, oscillating ribs or
3 spiral ribs.

1 41. A plurality of ducts for providing inner
2 pathways for receiving a plurality of cables, said ducts
3 having a longitudinal axis and a duct wall extending
4 about said axis, said duct walls including a collapsible
5 wall portion movable between an extended condition to
6 provide said ducts with a first cross-sectional area and
7 a contracted condition to provide said ducts with a
8 second cross-sectional area, said second cross-sectional
9 area being smaller than said first cross-sectional areas,
10 said ducts being connected longitudinally along their
11 exteriors to reduce relative movement between the ducts.

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1 42. The plurality of ducts of claim 41, wherein the
2 ducts have exterior ribs to reduce friction as they are
3 placed in a conduit.

1 43. The plurality of ducts of claim 41, wherein the
2 ducts have interior ribs to reduce friction as cables are
3 pulled into the ducts.

1 44. The plurality of ducts of claim 43, wherein the
2 ribs are longitudinal.

1 45. The plurality of ducts of claim 43, wherein the
2 ribs move in one direction then another.

1 46. The plurality of ducts of claim 41, which
2 further includes a strand of material attached along the
3 length of said ducts by which they may be suspended.

1 47. The plurality of ducts of claim 46, wherein the
2 strand of material are enclosed in an outer layer that
3 also encloses the conduit.

1 48. A method of installing a cable in an inner
2 pathway extending within a utility service line
3 comprising the steps of:

4 providing a duct including a collapsible wall to
5 form said inner pathway, said collapsible wall being
6 movable between an extended condition to provide said
7 duct with a first cross-sectional area and a contracted
8 condition to provide said duct with a second cross-
9 sectional area smaller than said first cross-sectional
10 area,

11 providing an adjustable opening in said service line
12 for receiving said duct, adjusting said opening to a

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13 clearance position for receiving said duct with
14 sufficient clearance to insert said duct into said
15 service line and to insert said cable into said duct when
16 the duct is in said extended condition,
17 mounting said duct in said service line by inserting
18 said duct through said adjustable opening into said
19 service line, moving said collapsible wall to said
20 extended condition and inserting said cable into said
21 duct, moving said collapsible wall to said contracted
22 condition, and adjusting said opening to a sealing
23 position for engaging said duct in a fluid tight seal
24 with said wall in said contracted condition.

1 49. A method as in claim 48, further including the
2 steps of providing said first mentioned adjustable
3 opening in said service line at an entrance location for
4 said duct, providing a second adjustable opening in said
5 service line at an exit location for said duct, said
6 second adjustable opening also being operable between
7 clearance and sealing positions, extending said duct and
8 cable through said service line and said second
9 adjustable opening in said clearance position, and
10 adjusting said first and second openings to said sealing
11 positions for engaging said duct with said wall in said
12 contracted condition in fluid tight seals and thereby
13 sealing said service line.

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